

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-III (NEW) EXAMINATION – WINTER 2021****Subject Code:3131905****Date:21-02-2022****Subject Name:Engineering Thermodynamics****Time:10:30 AM TO 01:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.
5. Use of steam table is permitted.

- Q.1** (a) Explain Guoy-Stodola theorem. **03**
 (b) Derive equation for filling of a tank. **04**
 (c) Prove that all reversible engines operating between same temperatures limits have are equally efficient. **07**

- Q.2** (a) Draw open cycle gas turbine diagram and represent simple Brayton cycle on T-s and p-V diagram. **03**
 (b) Distinguish between energy of non flow system and flow system. **04**
 (c) A simple Rankine cycle works between pressures 28 bar and 0.06 bar, the initial condition of steam being dry saturated. Calculate the cycle efficiency, work ratio and specific steam consumption. **07**

OR

- (c) 300 kJ/s of heat is supplied at a constant fixed temperature of 290°C to a heat engine. The heat rejection takes place at 8.5°C. The following results were obtained :
 (i) 215 kJ/s are rejected. (ii) 150 kJ/s are rejected. (iii) 75 kJ/s are rejected.
 Classify which of the result report a reversible cycle or irreversible cycle or impossible results. **07**

- Q.3** (a) State zeroth law of thermodynamics with its applications. **03**
 (b) Compare Otto, Diesel and Dual cycle for same compression ratio and heat supplied. Also show comparison on p-v and T-s diagram. **04**
 (c) A heat engine receives heat at the rate of 1500 kJ/min and gives an output of 8.2 kW. Determine : (i) The thermal efficiency , (ii) The rate of heat rejection. **07**

OR

- Q.3** (a) Define the following terms: **03**
 (i) Available energy, (ii) Unavailable energy, (iii) Dead state
 (b) What are the characteristics of entropy? Prove that entropy is a property of a system. **04**
 (c) 5 kg of water at 0°C is exposed to reservoir at 98°C. Calculate the change of entropy of water, reservoir and universe. Assume that specific heat of water is 4.187 KJ/Kg-K. **07**

- Q.4** (a) Draw block diagram of Vapour Compression Refrigeration system. Write down all four processes only. Also show these processes on p-h diagram. **03**
 (b) State the types of irreversibility. What is their effect? **04**
 (c) Prove that violation of Kelvin-Plank statement leads to violation of Clausius statement. **07**

OR

- Q.4** (a) Compare Brayton cycle and Rankine cycle. **03**
(b) Show that the COP of a heat pump is greater than the COP of refrigerator by unity. **04**
(c) Distinguish between energy of non flow system and flow system. **07**
Deduce the steady flow energy equation for a reciprocating compressor.

- Q.5** (a) Prove that entropy is the property of system. **03**
(b) Write short note on thermodynamic equilibrium. **04**
(c) Define following terms: state, path, process, isolated system, intensive property, quasi-static process, perfect gas. **07**

OR

- Q.5** (a) Draw the sketch of Rankine cycle p-V, T-s and h-s diagram (consider Inlet and exit to turbine is superheated and saturated steam respectively). **03**
(b) Describe quasi-static process. **04**
(c) Explain principle of increase of entropy. Apply it for the heat transfer through a finite temperature difference. **07**
